the workstations operable in parallel to retrieve and process three dimensional scene objects based on the retrieval request to create respective meshes of the retrieved three dimensional scene objects at a selected level of detail and to communicate the processed three dimensional scene object meshes over the communication network to the rendering pipeline of the first computer; and wherein

the first computer is operable to create a display representation of the selected view of the three dimensional scene from the received three dimensional scene object meshes.

34. The computer system as recited in claim 33, wherein the retrieval request specifies the location of each selected object in the three dimensional scene.

35. The computer system as recited in claim 33, wherein the three dimensional scene objects stored at the workstations include information concerning geometry, color and texture of the object.

36. The computer system as recited in claim 33, wherein the selected three dimensional scene objects are distributed in a predetermined manner amongst the plurality workstations for processing.

REMARKS:

By this amendment claims 1-5, 8, 13, 14, 19 and 21 have been cancelled without prejudice, claims 6, 7, 9, 11, 12, 15-18, 20 and 22 have been amended, and new claims 23-36 have been added. Claims 6, 7, 9 - 12, 15-18, 20 and 22 - 36 are now pending for consideration.

Claim Rejections under 35 US 102

Of the claims now pending in the application, claims 6, 7, 9 – 12, 15-18, 20 and 22 were rejected as anticipated by US Patent 5,963,209 (Hoppe), the Examiner

in particular relying on Hoppe at col. 14, lines 34-40 and 49-61. The rejection is respectfully traversed.

The specification of the present application contains disclosure in the "Description of Related" art, similar to that included in the Hoppe reference, form which the invention disclosed and claimed in the present application is differentiated. Hoppe clearly discloses a system (and method) that "comprises a transmitting computer 232 (such as a network or file server) and a receiving computer 233 (such as a client computer station or terminal) which are linked via a communications link 234" (col. 17, lines 37-41). The transmitting computer and the receiving computer each has the architecture of the computer system 50 shown in Fig. 5 of Hoppe (col. 17, lines 41-42).

Hoppe is not seen to disclose or suggest:

> "A method for utilizing a network of computers to render a three dimensional scene, comprising: sending a plurality of requests from a first computer to a plurality of other computers over a high speed network, the plurality of other computers each storing high resolution three dimensional scene objects, wherein the requests identify three dimensional objects stored at the plurality of other computers; operating the plurality of other computers in parallel to create a LOD mesh representation of the selected three dimensional objects stored at the other computers; and communicating the LOD mesh representations . . .."

as recited in method claim 6. Independent method claims 23, 28 and 31 are distinguished from Hoppe by at least similar features to those differentiating claim 6 from Hoppe.

Nor is Hoppe seen to disclose or suggest a computer system for rendering a three dimensional scene, including:

> ". . .a plurality of workstations, connected to the visualization console by a high speed network to enable the visualization console and the plurality of workstations to operate together; each of the plurality of workstations storing three dimensional objects, . . . and identification information stored at the visualization console identifying each of the three dimensional objects stored at the plurality of workstations; wherein the visualization console is operable under user control to communicate requests to the plurality of workstations over the high speed network, identifying respective ones of the three dimensional objects stored at the workstations representing a selected view of the three dimensional scene; the workstations are responsive to received requests to operate in parallel to create LOD representations of the respective stored three dimensional objects identified by the requests received from the visualization console and to communicate the LOD representations . . ."

as recited in claim 12. Independent system claims 17, 32 and 33 are distinguished from Hoppe by at least similar features to those differentiating claim 12 from Hoppe.

The distinctions between Hoppe's computer system and method of operation and the claims now pending in this application are further emphasized by Hoppe's description (e.g. col. 17, line 61 to col. 18, line 62) with reference to Fig. 12 of the "progressive transmission method" from the transmitting computer 232 to the receiving computer 233.

The dependent claims 7, 9, 10, 11, 15, 16, 18, 20, 22, 24-27, 29, 30, and 34-36 add further distinguishing features to their parent claims in a manner not seen to be disclosed or suggested by Hoppe.

Consequently, all claims now pending in this application are believed free from anticipation by Hoppe under 35 US 102 and not to be rendered unpatentable under 35 US 103 by Hoppe.

CONCLUSION:

It is believed that all of claims 6, 7, 9 - 12, 15-18, 20 and 22 - 36 now pending in the application are in condition for allowance; favorable consideration and early allowance of the application are respectfully solicited. If there are any remaining issues that could

be resolved by discussion, a telephone call to the undersigned attorney at (972) 702-7940 would be appreciated.

Attached hereto is a marked up version of the changes made to the specification and claims by the current amendment. The attached page is captioned **Version with markings to show changes made."**

Date: August 8, 2002

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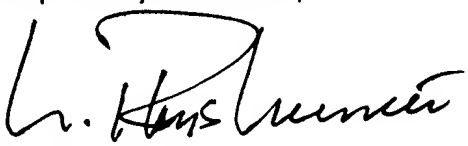
Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the claims:

Claims 1-5, 8, 13, 14, 19 and 21 have been cancelled.

The following claims have been amended as shown:

6. (Amended) A method for utilizing a network of computers to render a three dimensional scene, comprising:

sending a plurality of requests from a first computer to a plurality of other computers over a high speed network, the plurality of other computers each storing high resolution three dimensional scene objects, wherein the requests identify three dimensional objects stored at the plurality of other computers ~~to be rendered~~;

~~on each of~~operating the plurality of other computers~~,~~ in parallel to create ~~creating~~ a LOD mesh representation of the selected three dimensional objects stored at the other computers ~~received from the first computer~~; and

~~returning~~ communicating the LOD mesh representations of the selected three dimensional objects from the plurality of other computers over the network to the first computer, ~~thereby allowing~~ the first computer rendering the received LOD mesh representations and creating a ~~to~~ display thereof. ~~an image of the three dimensional objects.~~

7. (Amended) The method as recited in claim 6, further comprising:

initially distributing the high resolution three dimensional objects from the first computer for storage by ~~to~~ the plurality of other computers; and

associating identifiers with the three dimensional objects.

~~8. The method as recited in claim 7, further comprising:~~

~~on each of the plurality of other computers, inserting the three dimensional objects into at least one database accessible by each of the plurality of other computers; and~~

~~displaying the LOD representation of the three dimensional objects in a three dimensional scene on the first computer.~~

9. (Amended) The method as recited in claim 6, wherein the requests include a specified level of detail for creation of the LOD mesh representations from the stored high resolution ~~the~~ three dimensional objects.

10. The method as recited in claim 9, wherein the creating step includes creating LOD representations of the three dimensional objects with the specified level of detail as contained in the requests.

11. (Amended) The method as recited in claim 6, further comprising:

receiving an input from a user on the first computer;

processing the input to determine a first three dimensional scene that corresponds with the input; and

receiving subsequent inputs from the user and processing the inputs to determine subsequent three dimensional scenes that correspond with the subsequent inputs, wherein the user interactively controls the display of the subsequent three dimensional scenes by ~~his~~ subsequent inputs.

12. (Amended) A computer system for rendering a three dimensional scene, comprising:

a visualization console;

a plurality of workstations, connected to the visualization console by a high speed network to enable~~, wherein~~ the visualization console and the plurality of workstations to operate together~~; wherein,~~

each of the plurality of workstations storing three dimensional objects, the stored three dimensional objects collectively representing a three dimensional scene; and

identification information stored at the visualization console identifying each of the three dimensional objects stored at the plurality of workstations;

wherein the visualization console is operable under user control to communicate ~~sends a plurality of~~ requests to the plurality of workstations over the high speed network, ~~wherein the requests~~ identifying respective ones of the three dimensional objects stored at the workstations representing a selected view of the three dimensional scene~~to be rendered~~;

the workstations are responsive to received requests to operate in parallel to create LOD representations of the respective stored three dimensional objects identified by the requests received from the visualization console~~;~~ and

to communicate ~~the workstations return~~ the LOD representations of the selected three dimensional objects to the visualization console for assembly into a ~~, thereby allowing the visualization console to~~ display representation of the selected view ~~an image~~ of the three dimensional ~~object~~scene.

~~13. The computer system as recited in claim 12, wherein the visualization console distributes three dimensional objects to the plurality of workstations over the high speed network, and the workstations associate identifiers with the three dimensional objects.~~

~~14. The computer system as recited in claim 13, wherein each of the workstations inserts the three dimensional objects into at least one database accessible by each of the workstations and the visualization console displays the LOD representation of the three dimensional objects in a three dimensional scene.~~

15. (Amended) The computer system as recited in claim 12, wherein the requests include a specified level of detail for the LOD representations of the selected three dimensional objects to be created by the workstations~~three dimensional objects~~.

16. (Amended) The computer system as recited in claim 15, wherein the workstations create meshes comprising LOD representations of the three dimensional objects with the specified level of detail as contained in the requests.

17. (Amended) A computer system for rendering a three dimensional scene, comprising:

a visualization console;

a plurality of workstations, connected to the visualization console by a high speed network;

means for sending ~~a plurality of~~ requests from the visualization console to the plurality of workstations over the high speed network, wherein the requests identify three dimensional objects stored at the plurality of workstations~~to be rendered~~;

the workstations including means operable in parallel for creating a LOD representation of ~~the~~ each three dimensional ~~objects~~ object stored at a respective workstation and that is identified by a request received from the visualization console; and

each workstation also including means for ~~returning~~ communicating the LOD representations of the three dimensional objects to the visualization console, and

~~thereby allowing~~ the visualization console including means for assembling the received LOD representations of the three dimensional objects into a ~~to display an image of the~~ three dimensional ~~object~~scene display.

18. (Amended) The computer system as recited in claim 17, ~~further comprising:~~wherein the visualization console includes

means for distributing said three dimensional objects for storage at ~~to~~ the plurality of workstations over the high speed network.~~; and~~

~~means for associating associate identifiers with the three dimensional objects.~~

~~19. The computer system as recited in claim 18, further comprising:~~

~~means for inserting the three dimensional objects into databases accessible by each of the workstations; and~~

~~means for displaying the LOD representation of the three dimensional objects in a three dimensional scene.~~

20. (Amended) The computer system as recited in claim 17, wherein the requests include a specified level of detail for the LOD representations to be created from the three dimensional objects stored at the workstations.

~~21. The computer system as recited in claim 20, further comprising:~~

~~means for creating LOD representations of the three dimensional objects with the specified level of detail as contained in the requests on the workstations.~~

22. The ~~method~~ computer system as recited in claim 17, further comprising:

means for receiving an input from a user on the first computer;

means for processing the input to determine a first three dimensional scene that corresponds with the input; and

means for receiving subsequent inputs from the user and processing the inputs to determine subsequent three dimensional scenes that correspond with the subsequent inputs, wherein the user interactively controls the display of the subsequent three dimensional scenes by his subsequent inputs.

The following new claims 23-36 have been added:

23. (New) A method of displaying a three dimensional scene image, comprising:

from a first computer coupled to a display, transmitting a retrieval request to each of a plurality of second computers storing three dimensional scene objects distributively stored at said second computers together with associated identifiers, said stored three dimensional scene objects collectively representing a three dimensional scene, said retrieval request including identifiers associated with stored scene objects representing a portion of the three dimensional scene selected for display;

the second computers retrieving and processing in parallel three dimensional scene objects -stored at individual ones of the second computers based on each match between a three dimensional scene object identifier in the received request and a three dimensional scene object identifier stored at that second computer, the processing by the second computers creating respective meshes of the retrieved three dimensional scene objects at a selected level of detail;

the second computers communicating the processed three dimensional scene object meshes to the first computer to render and display a representation of the selected portion of the three dimensional scene assembled from the three dimensional scene object meshes communicated by the plurality of second computers to the first computer.

24. (New) The method as recited in claim 23, wherein each three dimensional scene object identifier includes the location of that object in the three dimensional scene.

25. (New) The method as recited in claim 23, wherein the three dimensional scene objects stored at the second computers include information concerning one or more of geometry, color and texture of the object.

26. (New) The method as recited in claim 23, wherein the stored three dimensional scene objects are distributed in a predetermined manner amongst the plurality of second computers.

27. (New) The method as recited in claim 23, wherein the three dimensional scene objects are stored at the second computers as high resolution models, and the processing carried out by the second computers creates respective meshes of the retrieved three dimensional scene objects at a selected lower level of resolution.

28. (New) A method of displaying a three dimensional scene image, comprising:

from a first computer coupled to a display, transmitting a retrieval request to each of a plurality of second computers storing three dimensional scene objects distributively stored at said second computers, said retrieval request including parameters describing a selected part of the three dimensional scene to be displayed;

the second computers responding to the retrieval request by selectively retrieving and processing in parallel according to said parameters, three dimensional scene objects stored by the second computers, the processing by the second computers creating respective meshes of the retrieved three dimensional scene objects at a selected level of detail; and

the second computers communicating the processed three dimensional scene object meshes to the first computer to display a representation of the selected part of the three dimensional scene assembled from the three dimensional scene object meshes communicated by the plurality of second computers to the first computer.

29. (New) The method as recited in claim 28, wherein the three dimensional scene objects stored at the second computers each includes information concerning one or more of geometry, color and texture of that stored object; and wherein said request parameters include for each object in the selected portion of the three dimensional

scene, an object identifier and the location of that object in the three dimensional scene.

30. (New) The method as recited in claim 28, wherein the stored three dimensional scene objects are distributed in a predetermined manner amongst the plurality of second computers, the three dimensional scene objects are stored at the second computers as high resolution models, and the processing carried out by the second computers creates respective meshes of the retrieved three dimensional scene objects at a selected lower level of resolution than the resolution of the stored three dimensional scene object.

31. (New) A method of displaying a three dimensional scene image, comprising:

initially, from a first computer coupled to a display, transmitting to and distributively storing at a plurality of second computers a plurality of three dimensional scene objects together with associated identifiers, said three dimensional scene objects stored at the second computers collectively representing a three dimensional scene, and storing at the first computer, identifiers for the respective three dimensional scene objects stored at the plurality of second computers;

subsequently, transmitting retrieval request from the first computer to the plurality of second computers, said retrieval requests including identifiers associated with selected ones of the three dimensional scene objects distributively stored at said second computers representing a portion of the three dimensional scene selected for display;

the second computers retrieving and processing in parallel three dimensional scene objects stored at individual ones of the second computers based on each match between a three dimensional scene object identifier in the received request and a three dimensional scene object identifier stored at that second computer, the processing by the second computers creating respective meshes of the retrieved three dimensional scene objects at a selected level of detail;

the second computers communicating the processed three dimensional scene object meshes to the first computer to display a representation of the selected portion of the three dimensional scene assembled from the three dimensional scene object meshes communicated by the plurality of second computers to the first computer.

32. A computer system for rendering a three dimensional scene, comprising:

a first computer including a display;

a plurality of workstations operably coupled to the first computer by communication network;

each workstation storing three dimensional scene objects, the three dimensional scene objects stored by the workstations collectively representing a high resolution three dimensional scene;

the first computer storing an object identifier for each three dimensional scene object stored at the plurality of workstations; the first computer operable to send over said communication links a retrieval request to the plurality of workstations including object identifiers associated with a selected plurality of said stored three dimensional scene objects representing a selected portion of said three dimensional scene;

the workstations operable in parallel to retrieve and process three dimensional scene objects stored at individual ones of the workstations corresponding to object identifiers in the received request to create respective meshes of the retrieved three dimensional scene objects at a selected lower resolution and to communicate the processed three dimensional scene object meshes over the communication network to the first computer; and wherein

the first computer is operable to render the received three dimensional scene object meshes and to create a display representation of said selected portion of the three dimensional scene.

33. A computer system for rendering a three dimensional scene, comprising:

a first computer including a rendering pipeline and a display;

a plurality of workstations operably coupled to the first computer by communication network;

a database of three dimensional scene objects collectively representing a three dimensional scene, said database accessible by the workstations;

each workstation storing references to said database entries;

the first computer operable to send over said communication links a retrieval request to the plurality of workstations identifying a selected plurality of said stored three dimensional scene objects representing a selected view of said three dimensional scene;

the workstations operable in parallel to retrieve and process three dimensional scene objects based on the retrieval request to create respective meshes of the retrieved three dimensional scene objects at a selected level of detail and to communicate the processed three dimensional scene object meshes over the communication network to the rendering pipeline of the first computer; and wherein

the first computer is operable to create a display representation of the selected view of the three dimensional scene from the received three dimensional scene object meshes.

34. The computer system as recited in claim 33, wherein the retrieval request specifies the location of each selected object in the three dimensional scene.

35. The computer system as recited in claim 33, wherein the three dimensional scene objects stored at the workstations include information concerning geometry, color and texture of the object.

36. The computer system as recited in claim 33, wherein the selected three dimensional scene objects are distributed in a predetermined manner amongst the plurality workstations for processing.

GP2672

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application No.: 09/428,679 Attorney Docket: P98-1866

Filed: 10/27/1999 Group Art Unit: 2672

Inventor: SELIGMAN, Adam L. Examiner: WALLACE, Scott A.

For: Method and Apparatus for Displaying Distributed Multiresolution Scenes

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- Amendment under 37 CFR 1.111 (23 pages)
- EOT Petition (1 page)
- Check No. 5984 - $724

on August 8, 2002
Date

N. Rhys Merrett

Signature

N. Rhys Merrett

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